

THE INFLUENCE OF SOME GROWTH SUBSTANCES ON INDUCTION OF ROOTS AND SHOOTS OF RENANOPSIS LENA ROWOLD

by

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INTRODUCTION

Renanopsis Lena Rowold (*Renanthera storiei* X *Vandopsis lissochiloides*) first raised in Hawaii by Oscar M. Kirch in 1948, is found growing at the Singapore Botanic Gardens. It is a monopodial type orchid with a thick woody stem. The plant produces large attractive inflorescences having dark red flowers with light orange markings. The inflorescences, often branched are about 100–135 cm long and each bears about 45–70 flowers.

Unfortunately, most of *R. Lena Rowold* plants do not produce sufficient roots along the stem and thus vegetative propagation by the normal method of cuttings is not possible. Monopodial orchids usually produce aerial roots along the stem and this is an important feature for vegetative propagation as cuttings made for propagation must have roots.

The aim of the experiment conducted at the Singapore Botanic Gardens recently was to promote the growth of shoots and roots by the application of growth substances on top cuttings, base cuttings and whole plants.

LITERATURE REVIEW

Plant propagation through shoot and root induction has been investigated by previous workers on various types of plants.

Hartmann et. al. (1956) reported that synthetic root-promoting chemicals which have been found most reliable in stimulating adventitious root production in cuttings are 3-indolebutyric-acid (IBA) and naphthalene-acetic-acid (NAA); while Bowen et. al. (1975) found that IBA and NAA increased the number of roots and reduced the time taken for the first roots to develop on cuttings of *Pinus contorta* Dougl. Warmke (1950) observed that application of IBA and NAA on distal or proximal part of root cuttings of *Taraxacum officinale* Weber and *Chicorium intibus* L. stimulated abundant root formation. Kunisaki (1975) reported that a cytokinin, 6-(benzylamino)-9-(2-tetrahydropyrynyl)-9H-purine (PBA), promoted shoot emergence on the stem bases of *Ascocenda*, a monopodial orchid; while Stewart et. al. (1977) observed that another cytokinin, benzyl adenine (BA) induced the growth of lateral buds at the base of plant species of *Paphiopedilum* and its hybrids.

Scheaffers (1970) reported that axillary buds of tobacco under apical suppression are stimulated by benzyl adenine (BA) when applied in a lanolin paste or in an aqueous solution.

MATERIAL AND METHODS

Three trials were conducted using plants of *R. Lena Rowold* (fig. 1) and in each trial, the growth substances were applied to a different part of the plant. The method of application was also different in each of the three trials.

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The treatments for all the trials were arranged in a Completely Randomized Design with five replicates for each treatment in trials I and II and four replicates for trial III as there was a shortage of plants.

Trial One

Top cuttings measuring about 40 cm in length were dipped in the various growth substance solutions for a period of three minutes. For uniformity, the cuttings were dipped up to and including the second nodal area.

- Treatments: A — 5000 ppm naphtalene-acetic-acid.
B — 5000 ppm indole-butyric-acid.
C — 5000 ppm naphtalene-acetic-acid. +
5000 ppm indole-butyric-acid.
O — control.

The cuttings after treatment were planted in pots using a potting media of broken bricks and charcoal chips. Weekly observations were made to record the dates of root formation, the number of developing roots and their lengths. (Fig. 2 and 3).

Trial Two

The basal portion of the potted plants from which the top cuttings had been used for Trial One were used for Trial Two. A wad of cotton wool soaked in the growth substance solutions was placed on the top of the cut surface and secured with the aid of rubber bands after covering the cotton wool wad with a small inverted polythelene bag. (Fig. 2 and 3).

- Treatments: A — 100 ppm benzyl adenine.
B — 2500 ppm indole-butyric-acid + 100 ppm benzyl adenine.
C — 2500 ppm naphtalene-acetic-acid +
100 ppm benzyl adenine.
O — control.

The cotton wool wads were removed 24 hours later and weekly observations were made to record the dates of shoot formation, the number of developing shoots and their lengths.

Trial Three

Plants which varied in height from 80–140 cm were inoculated with the various growth substance solutions with the aid of a hypodermic needle. For each treatment, 5 ml of the solution was used and this was inoculated into the nodal areas of the sixth to the ninth leaf. Inoculation of the solution was extremely difficult as the stem was hard and the bulk of the solution ran down the stem of the plant.

- Treatments: A — 100 ppm naphtalene-acetic-acid.
B — 250 ppm naphtalene-acetic-acid.
C — 100 ppm indole-butyric-acid.
D — 250 ppm indole-butyric-acid.
E — 100 ppm naphtalene-acetic-acid +
100 ppm indole-butyric-acid.
F — 250 ppm naphtalene-acetic-acid +
250 ppm indole-butyric-acid.
O — control.

Weekly observations were made to record the dates of root formation, the number of developing roots and their lengths.

RESULTS

Final results obtained at the end of a 14 weeks period are tabulated in tables I and II.

Table I: Number of roots produced (14 weeks).

Replicates Treatments	I	II	III	IV	V	Total	Average
A	6	5	3	2	9	25	5.0
B	2	2	2	5	2	13	2.6
C	4	3	7	3	2	19	3.8
O	0	2	4	3	1	10	2.0

By Fisher test of hypothesis for 95% level, number and length of roots recorded at the end of a 14 week period do not show any significant difference between treated and untreated plants. It is however observed that the treatment with 5000 ppm NAA produced the highest number of roots (Fig. 4 and 6), when compared with other treatments and the lowest number of roots was seen in the control (Fig. 4 and 6).

Table II: Average length of roots in mm (14 weeks).

Replicates Treatments	I	II	III	IV	V	Total	Average
A	82.0	38.4	61.6	3.5	75.0	260.5	52.1
B	115.0	82.5	37.5	63.0	75.0	373.0	74.6
C	56.7	13.3	51.0	68.3	8.0	197.3	39.5
O	—	60.0	5.2	45.0	15.0	171.2	34.2

The highest average length of roots is seen on the plants treated with 5000 ppm IBA (Fig. 5). Combination of 5000 ppm NAA and 5000 ppm IBA does not show any better effect on length of roots than the two other single application while number of roots produced is slightly higher than the treatment with 5000 ppm IBA and the control. Untreated plants do produce roots but have the lowest number of roots and these also have the lowest length average (Fig. 4 and 6).

Trial Two

Final results obtained at the end of a 14 week period are tabulated in tables III and IV.



Fig. 1.

A potted plant of *Renanopsis* Lena Rowold. Roots are not found growing along the length of the plant.



Fig. 2.

Left — Top portion of plant used for Trial One.

Right — Basal portion of plant used for Trial Two.



Fig. 3.

Left — Trial One, top portion of plant potted after treatment.

Right — Trial Two, basal portion of plant with wad of cotton wool secured at the top.



Fig. 4. Trial One.
Left — untreated.
Right — treated with 5000 ppm NAA.



Fig. 5. Trial One.
Left — treated with 5000 ppm IBA.
Right — treated with 5000 ppm NAA and 5000 ppm IBA.

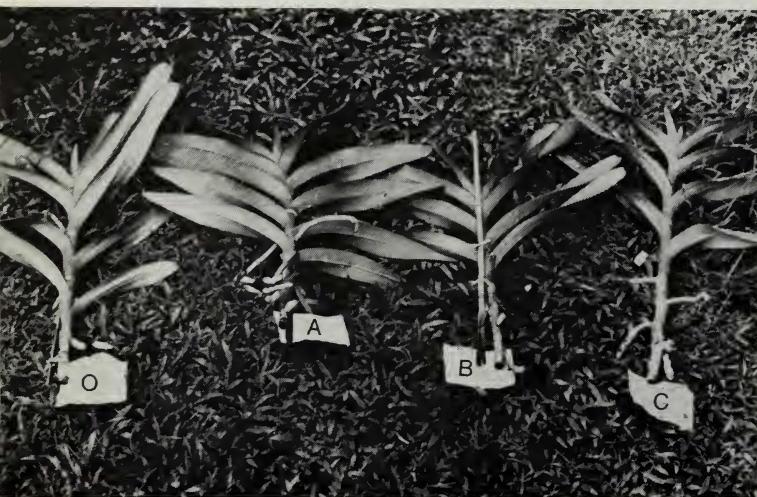


Fig. 6.
Trial One.
Control and treatments A,B,C.



Fig. 7.
Trial Two.
Abnormal growth of roots on the plants treated with 2500 ppm NAA combined with 100 ppm Benzyl — adenine.

Table III: Number of shoots (14 weeks)

Replicates Treatments	I	II	III	IV	V	Total	Average
A	1	0	0	2	1	4	0.8
B	4	0	0	0	0	4	0.8
C	0	2	1	0	2	5	1.0
O	0	1	1	1	1	4	0.8

Table IV: Average length of shoots in mm (14 weeks)

Replicates Treatments	I	II	III	IV	V	Total	Average
A	30.0	—	—	18.0	60.0	108.0	21.6
B	3.7	—	—	—	—	3.7	0.7
C	—	2.0	—	2.0	2.0	6.0	1.2
O	—	30.0	60.0	3.0	40.0	133.0	26.6

Results obtained at the end of a 14 week period do not show any significant difference between the various treatments and control. It is however observed that plants treated with 2500 ppm naphthalene-acetic-acid combined with 100 ppm benzyladenine produced abnormal growth of roots. The roots produced are about three times thicker than the normal (Fig. 7).

Trial Three:

Final results obtained at the end of a 14 week period are tabulated in tables V and VI.

Table V: Number of roots produced (14 weeks).

Treatments Replicates	A	B	C	D	E	F	O
I	1	0	0	0	1	0	3
II	1	0	0	1	1	0	0
III	0	0	0	0	0	0	3
IV	3	0	0	1	0	0	0
Total	5	0	0	2	2	0	6

Table VI: Average length of roots in mm (14 weeks).

Replicates Treatments	A	B	C	D	E	F	O
I	100.0	—	—	—	180.0	—	60.0
II	185.0	—	—	145.0	55.0	—	—
III	—	—	—	—	—	—	101.0
IV	100.0	—	—	106.0	—	—	—
Total	385.0	—	—	251.0	235.0	—	161.0

As shown in table V and VI, the number and average length of roots recorded at the end of the experiment (14 weeks) do not show any significant effect of growth substances when compared with the control.

DISCUSSION AND CONCLUSION

It is observed that top cuttings which were soaked for three minutes in 5000 ppm of Naphtalene acetic acid produced the largest number of roots while those which were soaked in 5000 ppm indole-butyric-acid produced the longest roots though fewer roots were produced with this treatment. It has been shown that top cuttings of *Renanopsis* Lena Rowold which have no roots along their stem can be successfully grown without the application of growth substances but the use of growth substances like naphtalene-acetic-acid and indole-butyric-acid is preferable.

It is possible that the observation period was too short and had the experiment been conducted for a longer period of time, results obtained with the various treatments may have been significant.

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